

PSI

Sustainable Campus Conference  
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## Greenhouse Gas Reduction Strategies at the Paul Scherrer Institut

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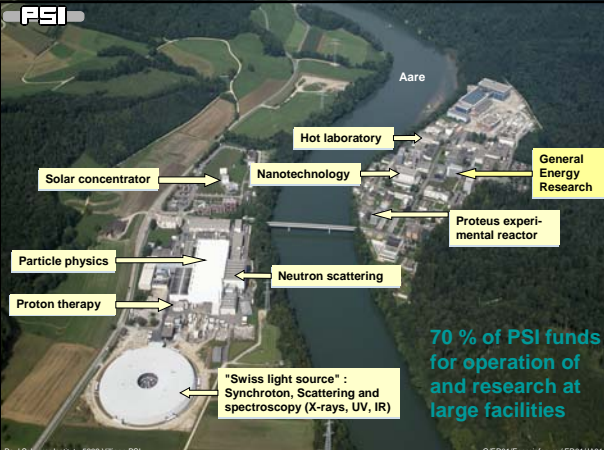
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### The Paul Scherrer Institute – A Swiss National Research Laboratory in Villigen



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Hot laboratory

Solar concentrator

Nanotechnology

General Energy Research

Proteus experimental reactor

Particle physics

Neutron scattering

Proton therapy


"Swiss light source":  
Synchrotron, Scattering and spectroscopy (X-rays, UV, IR)

70 % of PSI funds for operation of and research at large facilities

Paul Scherrer Institut • 5232 Villigen PSI      G:ER01/Energieforum / ER01/UA01

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### Proton Accelerator



Proton energy:  
600 MeV

Proton current:  
2 mA


Circulating power:  
1.2 MW

Total power consumption:  
14 MW  
(rf and magnets)

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### Swiss Light Source (SLS) Third Generation Synchrotron, started operation in 2001



Electron energy:  
2.4 GeV

Electron current:  
350 mA

Installed beamlines:  
12 stations

Total power consumption:  
2.8 MW  
(mainly magnets  
+radio frequency)

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### Switching off the light at the side of a 14 MW machine ?

Decrease power consumption of the proton accelerator

New buildings – implementation of Minergie standards

Building renovations – energetic efficiency

Mobility of employees

Pilot project "Energy hub at the PSI"

Utilizing waste heat from cooling of magnets and radio frequency cavities  
for heating of buildings + feeding into district heating networks

Compensating CO<sub>2</sub> from air travel –  
producing methane from biomass and use in "Mobility" vehicles

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## Upgrading of the proton accelerator

in operation since 1974

current was successively increased from few  $\mu\text{A}$  to 2 mA

further increase to 3 mA planned until 2011

successive replacement of the 4 old cavities by new low-loss Cu cavities

## Incentives for changing mobility behaviour

PSI is located in Villigen (AG), on the countryside, 37 km north of Zurich.

Of the 1400 employees,

40 % live in Zurich and other cities

40 % live in small towns and villages around Villigen

20 % live elsewhere in Switzerland and Germany.

Many employees come to work by car.

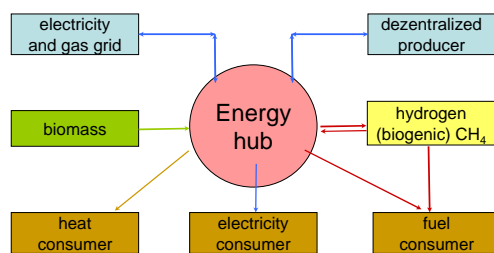
→ Work with railroad / bus to ensure short transfer time from Zurich (40').

→ Use parking fees to pay for public busses servicing PSI.

→ Provide a site for renting 'Mobility' cars in Zurich.

→ Develop a web-based tool for easy car sharing.

## Energy Hub Concept developed by ETH Zurich and PSI



hub at the level of block / village / city district, typical power rating: > 1 MW

## Realizing an Energy Hub at PSI

District heating with "waste" heat from nearby Beznau nuclear power station, and heat recovery, already implemented.

Separate loops for hot water (60 °C) and room heating (< 50 °C)

Short automatic shut-offs of the proton beam are causing load changes of 1 MW → accommodate locally rather than leaving management to grid.

Project 1:

Utilize plentiful low-quality waste heat from the magnets and rf cavities for driving the cooling of equipment and laboratories.

Project 2:

Demonstrate the local production of methane from biomass as a fuel for 'natural gas' vehicles.

## Compensating greenhouse gases from air travel

Ongoing initiatives (e.g. myclimate, spin-off of ETHZ) propose to compensate CO<sub>2</sub> emissions of air travel on a voluntary basis, by financing international certified CO<sub>2</sub> reduction projects.

As a research institution active in the field, PSI studies a compensation project of its own.

- production of green biomass
- hydrothermal gasification to produce methane
- installation of a small gas filling station
- use as a fuel in natural gas vehicles in the 'Mobility' car fleet positioned at PSI.